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Energy Cost of a Water Savings Policy in Morocco: A SAM Assessment

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INTRODUCTION

- Demand for water, food and energy is expected to rise by 30-50% in the next two decades

- It is necessary to improve policy coordination and harmonization to account for trade-offs and build on the increased interconnectedness of WEF. Part of this process is promoting, identifying and eliminating contradictory policies (World Economic Forum, 2011).

- There is a relatively limited understanding of how to tackle these complex relationships when conducting assessments and taking action.

- Morocco illustrates well this problem

OBJECTIVES

- To show the limit of sectoral policies when they are not integrated in a more global economic development strategy.

- Using a SAM allows to measure indirect and induced effects at the sectoral level and that these effects may exceed direct sectoral policy effects.

- Applying a SAM approach to analyze WEF nexus in the case of Morocco energy and agricultural policy

Irrigated Area by Type and by System of Irrigation in 2006 (in hectares)

Irrigation systems	Gravity	Sprinkler	Localized	Total	%
Collective Large Scale	533 900	113 800	34 900	682 600	46.8
Collective Small & Medium	327 200	6 900		334 100	22.9
Individual	317 600	16 950	106 900	441 450	30.3
Total	1 178 700	137 650	141 800	1 458 150	100.0
%	80.8	9.4	9.7	100.0	

Objectives of current irrigation policy :

- 550 000 ha to be reconverted from gravity irrigation to localized irrigation to "save" 2 Billions m3/year
- 110 000 ha of expansion

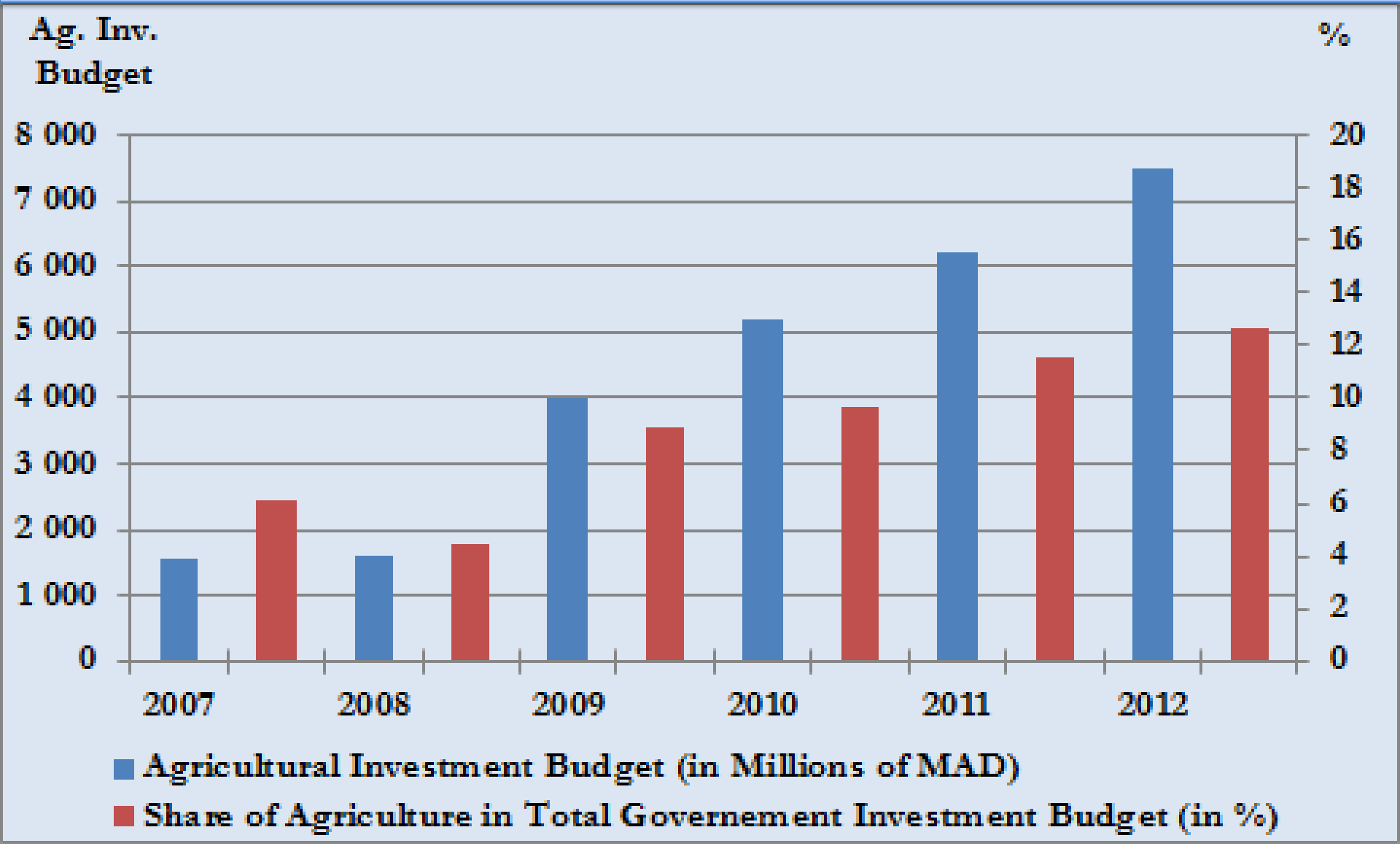
Subsidies : almost 100% (61 billion MAD)

Rec: 111 000 MAD/ha

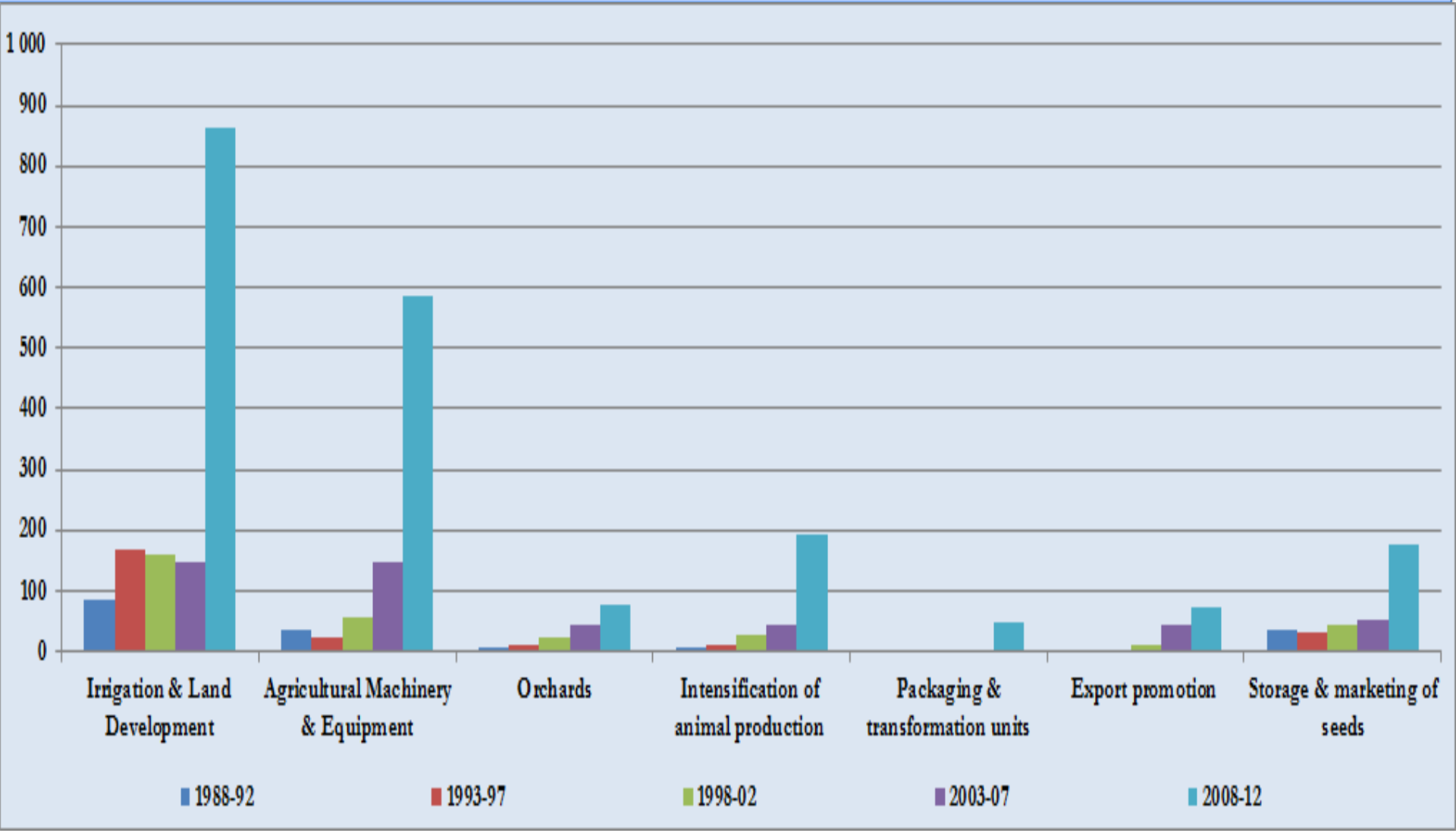
Land and Number of Holdings Distribution (in %)

Holding Sizes (in ha)	Cropping land				Number of holdings			
	Rainfed		Irrigated		Rainfed		Irrigated	
0 - 1	1.5		4.8		18.2		28.2	
1 - 3	9.7	22.6	14.1	31.8	32.1	67.9	29.7	72.9
3 - 5	11.4		12.9		17.7		14.9	
5 - 10	21.8		21.1		18.3		15.7	
10 - 20	22.5		15.9		9.5		7.5	
20 - 50	18.2	77.4	13.2	68.2	3.5	32.1	3.1	27.1
50 - 100	6.8		6.1		0.5		0.6	
≥ 100	8.2		11.9		0.2		0.3	
Total	100.0		100.0		100.0		100.0	
Shares	85.7		14.3		63.4		36.6	

Ministry of Agriculture Investment Budget (in Millions of MAD) and its Share in Total Government Investment Budget (in %)



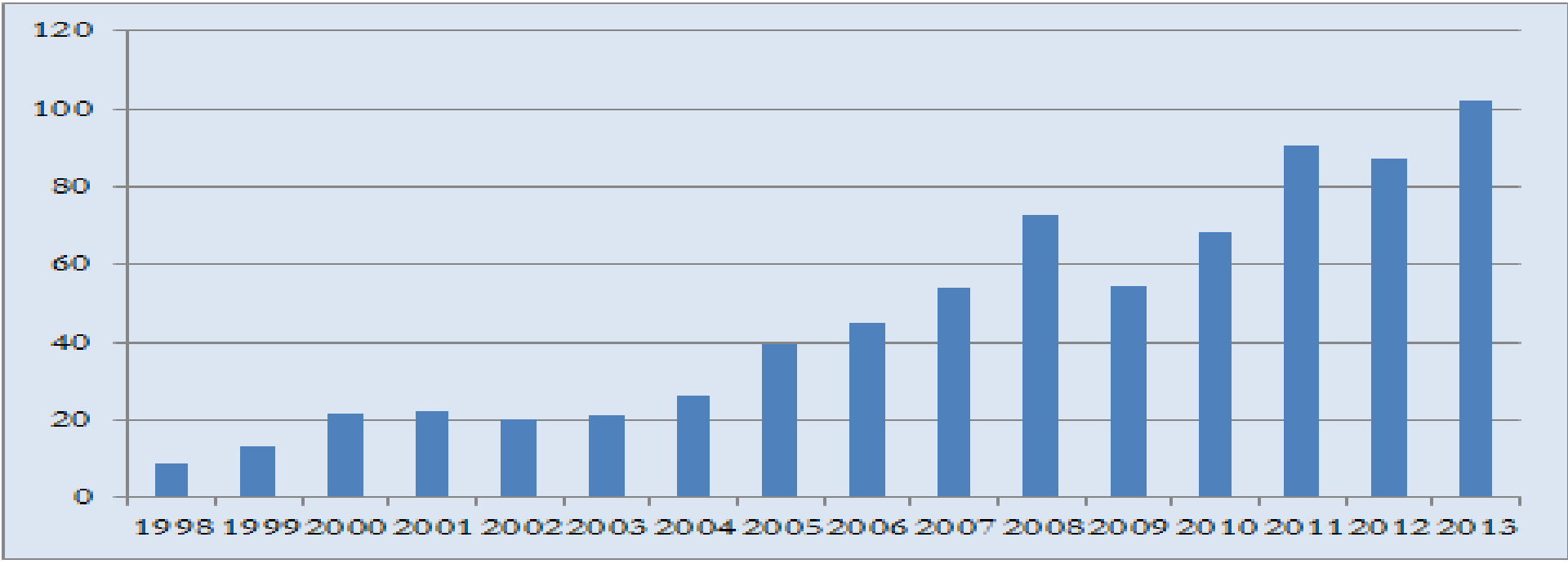
Average Yearly Agricultural Investment Subsidies by Type of Investment (in millions of MAD)



Energy Gross Domestic Consumption by Origin (in ktoe)

	Coal	Crude-Oil	Oil derived Products	Natural Gas	Rene-wable	Electri-city	Others	Total
KTOE	3 025	5 186	5 954	801	232	396	1 940	**17 534**
%	17.3	29.6	34.0	4.6	1.3	2.3	11.1	**100.0**

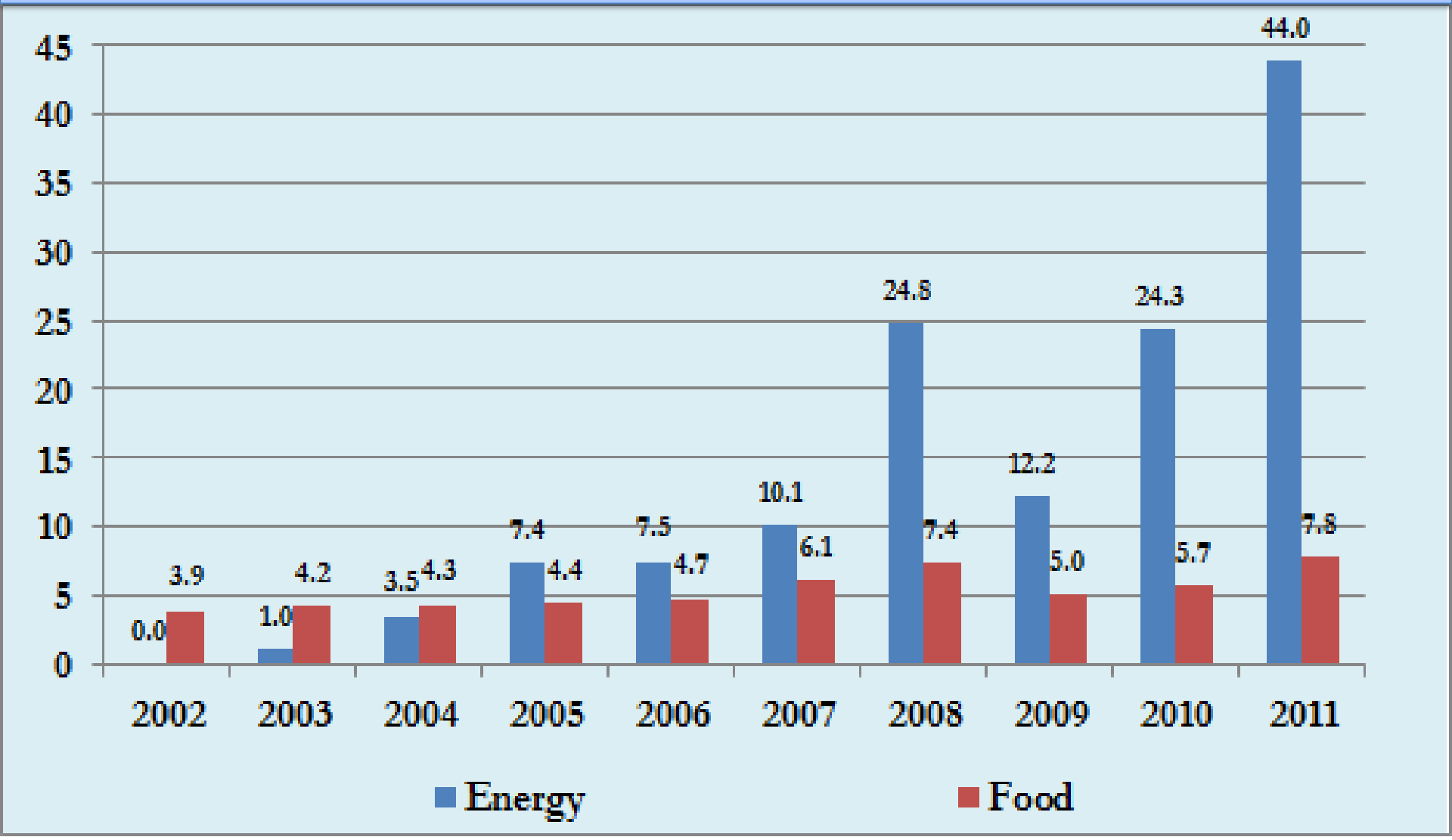
Imports Energy Bill (in Billions of MAD)



Energy Final Consumption by Origin and by Sector of Use (in ktoe)

Sectors	Oil Products					Electricity	Total	
	Diesel	Gasoline	Gas	Others	S.Total		ktoe	%
Households	19	0	1 326	6	1 351	724	**2 075**	**16.5**
Agriculture	765	10	774	0	1 549	132	**1 681**	**13.4**
Transportation	4 079	620	0	600	5 299	26	**5 325**	**42.4**
Industry	71	-25	197	1 907	2 150	1 326	**3 476**	**27.7**
Total	**4 934**	**605**	**2 297**	**2 513**	**10 349**	**2 208**	**12 557**	100.0
%	**39.3**	**4.8**	**18.3**	**20.0**		**17.6**	**100.0**	

Subsidies to Commodities from 2002 to 2011 (in billions of MAD)



Data

- Energy Balance sheet of 2011, Ministry of Energy
- Energy Model for 2007, HCP 2012.
- Agriculture Satellite Account for 2009, Ministry of Agriculture / Agency for Progress and Partnership/Millinium Challenge Account, 2012
- 2011's Agriculture Crop areas and Productions Statistics, Ministry of Agriculture
- 2011's Agriculture Producers prices Statistics, Ministry of Agriculture
- PPI, CPI, and Sale Prices prices, HCP
- 2011's Supply-Use Table, 2012 National Accounts (Base 1998), HCP, June2013

Accounts retained in disaggregating the SAM of 2011 (77 accounts)

Activities (33)	Commodities (30)	Factors and Institutions (14)
Rainfed Cereals and Pulses	Agriculture, forestry and related services	Gross Wages
Irrigated Cereals and Pulses	Fishery products	Gross Operating Surplus / gGoss Mixed income
Rainfed Fodders	Coal	households
Irrigated Fodders	Crude Oil	State
Rainfed Industrial Crops	Natural Gas	Taxes on production
Irrigated Industrial Crops	Other Products of the Mining Industry	Production subsidies
Irrigated Vegetable Crops	Food and Tobacco Industries	Tariffs and taxes on imports
Fruit Tree Crops	Textile and Leather	Value added taxes
Fruit Tree Crops	Chemical and Para-chemical Industries	Taxes on Commodities
Other Agriculture, Forestry and Auxiliary Services	Mechanical, Metallurgical and Electrical Industries	Subsidies to Commodities
Fisheries, Aquaculture	Manufacturing and Other Industries.(excluding oil refining)	Direct Taxes (income taxes)
Mining Industries	Gasoline	Saving / Gross Fixed Capital Formation
Food and Tobacco Industries	Diesel	Inventories Variations
Textile and Leather	Butane and Propane	Rest of the world
Chemical and Para-chemical Industries	Other Petroleum Products	
Mechanical, Metallurgical and Electrical Industries	Thermal Electric Power	
Manufacturing and Other Industries.(excluding oil refining)	Hydro-Electricity	
Refining of Oil and Other Energy Products	Wind Electricity	
Thermal Electric Power	Solar Electricity	
Hydro-Electricity	Water	
Wind Electricity	Construction and Public Works	
Solar Electricity	Commerce	
Water	Hotels and Restaurants	
Construction and Public Works	Transportation	
Commerce	Post and Telecommunications	
Hotels and Restaurants	Financial and Insurance Activities	
Transportation	Real Estate, Renting and Serv. Made Companies	
Post and Telecommunications	Public Administration and Social Security	
Financial and Insurance Activities	Education, Health and Social Work	
Real Estate, Renting and Serv. Made Companies	Other Non-Financial Services	
Public Administration and Social Security		
Education, Health and Social Work		
Other Non-Financial Services		

Methodology

Beside using standard methods to update the 2009 SAM to 2011, the accounts involving energy had to be readjusted in the national accounts of 2011 to reflect the use of energy by type as given by the national Energy Balance Sheet elaborated by the Ministry of Energy for 2011.

These adjustments were necessary, given the official supply-use table of 2011 has as a base the year 1998, and can only underestimate the use of energy in the agriculture sector.

Only the ROW and the Saving-Investments accounts are taken as exogenous in computing the SAM Multipliers. The Government budget account is considered an exogenous one since one of the objective is to evaluate the likely impact of alternative policies on the Government budget.

18 Accounts Aggregated SAM of Morocco – Year 2011 (in Millions MAD)

		RC_A	IC_A	AAg_A	Mg_A	RefO_A	Elect.	OActi.	Ag_C	FE_C	PD_C	Elect.	OGS	L+K	HH+GB	Tax	Subs	Inv.	RDM	Total
Rainfed Crops	RC_A								34 010											34 010
Irrigated Crops	IC_A								51 788											51 788
Other Ag. Forest &,AServices	AAg_A								45 396				7 305							52 701
Mining Industries	Mg_A												49 135							49 135
Refining of Oil and O En.Product	RefO_A									197	49 837		241							50 275
Electricity	Elect.											23 256	614							23 870
Others Activities	OActi.								25 042	657	6 984		1 022 719							1 055 402
Agriculture, forestry & AServices	Ag_C	5 250	6 141	7 132	23			54 889							80 288			18 879	10 545	183 146
Fossile Energy Products	FE_C				65	47 446	4 410	179										-14 185	0	37 915
Petrolieum Deriv. Energy Produc	PD_C	420	5 874	3 824	2 269	3	2 496	26 705							33 685			4 295	8 862	88 431
Electricity	Elect.		1 347	101	888	193	585	13 025							12 145				289	28 572
Other Goods and Services	OGS	1 151	3 937	5 517	4 460	688	2 448	331 413							552 030			269 723	267 784	1 439 151
Primary Factor (L+K)	L+K	27 189	34 489	36 098	40 496	1 919	13 705	624 372												778 268
Institutions	HH+GB													778 268	329 708	168 321	-51 589		74 155	1 298 863
Taxes	Tax			30	935	27	228	5 212	3 606	29	22 162	1 878	83 268		50 947					168 321
Subsidies	Subs							-392			-44 338		-6 859							-51 589
Saving															214 166			32 318	104 171	350 654
Rest of the world	RDM								23 303	37 032	53 786	3 438	282 727		25 894			39 625		465 805
	Total	34 010	51 788	52 701	49 135	50 275	23 870	1 055 402	183 146	37 915	88 431	28 572	1 439 151	778 268	1 298 863	168 321	-51 589	350 654	465 805	

GDP :	844 053	Exports/imports	71.82%
Import:	400 286		
Exports	287 480	Energy Net Imp./Tot. Imp	21.26%
Energy Net Imp.	85 105	Energy Taxes /Energy Subs.	49.99%

RESULTS : Subsidies and Investment Budget Costs

1) Energy subsides budgetary cost (in Millions MAD) :

Energy Product	Total subsidies	Subsidies to Agriculture
Gasoline	1 878	29
Fuel Oil	16 695	2112
Gas (butane and propane)	13 715	3037
Others Oil Products	10 419	
Total Subsidies for PP	**42707**	**5178**
Subsidies through electricity		83
Total Energy Subsidies	42707	**5260**

2) Investment cost

Reconversion Cost:

- Total : MAD 61 Billions
- Per ha : MAD 111 000

Large Scale Irrigation Expansion Cost:

- Total : MAD 25 Billions
- Per ha : MAD 138 000

RESULT : SAM Multipliers

	Rainfed Cereals and Pulses	Irrigated Cereals and Pulses	Rainfed Fodders	Irrigated Fodders	Rainfed Industrial Crops	Irrigated Industrial Crops	Irrigated Vegetable Crops	Rinfed Fruit Tree Crops	Irrigated Fruit Tree Crops
Total Commodities	**2.34**	**2.14**	**2.38**	**2.11**	**2.17**	**2.16**	**2.29**	**2.18**	**2.08**
Energy	0.31	0.59	0.31	0.47	0.28	0.39	0.38	0.29	0.48
Others commodities	2.03	1.55	2.07	1.63	1.89	1.78	1.91	1.89	1.60
Value added	**1.84**	**1.33**	**1.83**	**1.65**	**2.01**	**1.77**	**1.70**	**1.98**	**1.60**
Salaries	0.43	0.38	0.38	0.35	0.38	0.37	0.36	0.38	0.35
Capital rent	1.41	0.95	1.45	1.30	1.63	1.41	1.34	1.60	1.26
Institutions Rev.	**2.68**	**1.83**	**2.67**	**2.33**	**2.92**	**2.54**	**2.43**	**2.88**	**2.26**
Households	2.28	1.62	2.27	2.02	2.48	2.18	2.09	2.45	1.97
Government budget	0.40	0.21	0.40	0.31	0.44	0.36	0.34	0.43	0.30
Taxes net of subs.	**0.17**	**0.05**	**0.17**	**0.11**	**0.19**	**0.14**	**0.14**	**0.18**	**0.11**
Taxes	0.26	0.23	0.26	0.25	0.26	0.25	0.25	0.26	0.24
Subsidies	0.08	0.18	0.09	0.14	0.08	0.11	0.11	0.08	0.14

Conclusions : The case of Morocco

- The high cost of energy and budget for irrigation in agriculture benefits to only 16% of total arable land.

- In terms of number of farmers, 36% of them could benefit from energy and irrigation subsidies, including 73% who have less than 5 ha and in majority are using butane.

- Indirect subsidies, through energy (MAD 5.3 billions in 2011), exceed largely the direct subsidies in the agricultural sector (Agricultural Investment fund : MAD 2.3 Billions in 2011)

- SAM multipliers show that investments in rainfed agriculture could be more profitable for the economy of the country (**Risk !!**).

Conclusions : In general

The Nexus approach advocates for greater policy coherence and links across different policy levels and sectors to meet the challenges associated with the distribution of scarce resources.

In such a context, SAM has helped to overcome one-sided sectoral thinking and sector-biased planning, management and implementation. Such a tool could support the design of more efficient policy frameworks.

To be fully efficient, there is a need for reliable and more precise statistical data, especially to better assess the links between different production activities and the impact of different policy alternatives.